Common T&E and Training Airborne Instrumentation
"A Practical Approach for the 21st Century"

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Presented at

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

The 4th Annual Testing and Training for Readiness Symposium & Exhibition
" Emerging Challenges, Opportunities and Requirements"

August 2001
Orlando, Florida

SCOPING THE PROBLEM

- **Throughout the last 20 years, there have been an incredible number of different airborne Test and Training systems developed.**
- **Many of these systems provide similar types of data and information for test and training requirements.**
- **In most cases the similarities end there.**
- **These systems are in large part incompatible with each other and vary greatly in many different areas.**
  - **Data Links**
  - **Data Formats**
  - **Hardware**
  - **Level of Documentation**

SCOPING THE PROBLEM

- **Why is working toward common airborne Test and Training Instrumentation so important?**
  - **There is a growing requirement to conduct Test and Training (T&T) evaluations simultaneously.**
  - **Proliferation of T&T tracking systems is extensive.**
  - **Critical differences in existing T&T tracking systems prevent a seamless transition between the two communities.**
  - **Large investments have been made to develop and procure the wide variety of existing T&T tracking systems.**
  - **Funding for future systems and upgrades to existing systems, is very limited.**
  - **Standardized T&T instrumentation systems will result in large cost savings in procurement and long term sustainment.**

SCOPING THE PROBLEM

- **A good example of the problem facing Test and Training communities can be seen in the results of an ongoing study in this area.**
- **The Range Commanders Council's (RCC) Electronic Trajectory Measurement Group (ETMG) has a task to create standards for use in the procurement of all future Test and Training airborne instrumentation systems (TSPI & Training Data).**
- **Scope of the current study includes:**
  - **GPS based TSPI pods/plates in use at Test Ranges**
  - **Pods and plates in use at Training Ranges including:**
    - » **Multilateration based**
    - » **GPS based**

SCOPING THE PROBLEM
T&T SYSTEM PROLIFERATION

Military Service	Configuration	Info Source	Quantity	Usage
USA	**TDARDS**	WSMR	16	Test
	IVTS	YPG	16	Test
	HELLFIRE TUBES	YPG	2	Test
	MAIS (AN/ARQ-52 P/N 7565900)	Ft Hood	3	Train
	IGI (ARDS pod variant)	Ft Bliss	13	Train
	Low Dynamic Plate	Ft Bliss	26	Train
	Low Dynamic Plate – enhanced	Ft Bliss	3	Train
	ATTC SYS (OEM GPS/INS pkg)	Ft Rucker		Test
	C-MIGITS II (N308A)		4	
	Strapdown (K600A292SM)		6	
USN	**Relay, Reporter, Responder AIS PODS** (141 MHz)	NAWCWD		
	AN/URY-2		60	Test
	Relay, Reporter, Responder AISI PLATES (141 MHz)	NAWCWD		
	AN/URY-1		49	Test
	TACTS AIS PODS (P4A)	PMA-248	357	Train
	TACTS AISI PLATES (F/A-18, AV8, RW)	PMA-248	205	Train
	LATR AIS POD (433 MHz – RCUBED)	PMA-248	93	Train
	LATR AISI PLATES (433 MHz – R CUBED)	PMA-248	173	Train
	LATR SHIPBOARD (433 MHz – R CUBED)	PMA-248	75	Train
	JTCTS AIS PODS	PMA-248		
	AN/ASQ-T37 (USN PLANNED)		$(201)^2$	Train
	(USAF PLANNED)		$(980)^2$	
	JTCTS AISI PLATES	PMA-248		
	AN/ASQ-T36 (USN PLANNED)		$(612)^2$	Train
	JTCTS SHIPBOARD/MOBILE	PMA-248		
	AN/ASQ-ATR Common (USN PLANNED)		$(40)^2$	Train
	NUWC PORTABLES	NUWC-KPT		Test
	DL 404399		18	
	DL 405204		15	

SCOPING THE PROBLEM
T&T SYSTEM PROLIFERATION

Military Service	Configuration	Info Source	Quantity	Usage
USAF	**ARDS/EATS AIS PODS** ARDS AN/ARQ-52(V)2 ARDS AN/ARQ-52B(V)2 ARDS AN/ARQ-52B(V)17 ARDS AN/ARQ-52(MAIS) EATS AN/ARQ-52(V)1 EATS AN/ARQ-52B(V)1	AAC/WRR	206[1]	Test/Train
	ARDS/EATS AISI PLATES ARDS AN/ARQ-52(V)8 ARDS AN/ARQ-52B(V)8 ARDS AN/ARQ-52B(V)8 – (F-22) ARDS AN/ARQ-52B(V)18 EATS AN/ARQ-52B(V)12	AAC/WRR	114[1]	Test/Train
	CACR R-2604/U SIX CHANNEL RCVR, RADIO R-2604A/U TWELVE CHANNEL RCVR, RADIO	AAC/WRR	 544[1] 58[1]	Test/Train
	GRDCS AN/ARQ-52 (D-5)	46TW	 15	Test/Train
	GAINR	412TW	12	Test
	TIP (P4B Variant) **AARI** (ARDS Variant w/GNP-LN200) **NCTI** (TIP Variant w/GNP) AIS PODS AISI PLATE	46TW 412TW	6 14 3 1	Test Test Test

SCOPING THE PROBLEM
T&T SYSTEM PROLIFERATION

Military Service	Configuration	Info Source	Quantity	Usage
USAF	**ACTS**	RAMPOD		Train
	ASQ-T21 (HAIS)		34	
	ASQ-T28 (BAIS)		4	
	ASQ-T35 (P4N)		153	
	ASQ-T25J (P4KM)		1	
	ASQ-T34 (KITS/AKITS)		54	
	ASQ-T27A (P4G)		110	
	N/A (P4A)		5	
	ASQ-T25 (P4AM)		229	
	ASQ-T29 (P4AW)		40	
	ASQ-T20 (P4AX)		107	
	ASQ-T27 (P4B)		277	
	TBD (P4BE)		39	
	ASQ-T27(V)1 (P4BX)		111	
	URITS (Lease – P4A Variant)	AAC/WRR	88	
	MISC OEM GPS RCVR (ALL RANGES) REF: Rcc Doc 259-99 AND INTERVIEWS		(>250)[2]	
	55 Configurations		**3,359**	GRAND TOTAL
	JTCTS to be phased into USN/USAF training units (Phase Schedule UNK)		(1,833)	

Notes -

1 – Distributed among 3 services
2 – Not included in grand total

WHERE TO BEGIN?

- **There are several things that have been initiated to start the process of correcting this problem.**
- **The Joint Test & Training Range Roadmap (JTTRR).**
  - **This roadmap is maintained by the T&E JPO in support of DOT&E.**
  - **It attempts to track and map all the new T&T systems that are planned as well as planned upgrades to existing systems.**
    - » **The goal is to identify overlap in requirements.**
  - **However, it is only as good as the accuracy of the data provided and the frequency of updates.**
  - **In addition, it only provides general programmatic information on planned programs and not any of the detailed requirements of the proposed procurements.**
  - **It does not provide a real solution to fixing the problem, especially for all the existing systems that will be undergoing upgrades.**

WHERE TO BEGIN?

- There are several CTEIP programs underway that partially address this issue as well.
  - Flexible Interoperable Transceivers (FIT) program.
  - Foundation Initiative 2010 (FI-2010) program.
- The FIT program (formerly the FIRST program) has been ongoing for at least 10 years in some form or fashion.
  - The goal of the FIT program is to establish a common data link architecture and data modulation scheme.
  - The main problem with this program is that it is designing an architecture and modulation scheme to meet the T&T requirements of early to mid 1990's.
    - » Current and emerging T&T data link requirements involve considerably more data and much higher data rates than was envisioned at the start of the FIT program.

WHERE TO BEGIN?

- **FI-2010's goal is to design a standard software architecture for use in all range instrumentation.**
  - **This program has made great strides in accomplishing this objective.**
  - **There is a very high chance of success for this program and it will go a long way in standardizing how the data generated from airborne T&T systems is handled and processed.**
  - **The problem with this program is that it does not address any of the hardware incompatibility issues.**
    - » **Individual T&T system sub-components, including design, capabilities and interfaces.**
    - » **T&T system data formats (Interface Control Document issues)**
    - » **Aircraft interfaces.**
    - » **Etc.**

PROPOSED PRACTICAL APPROACH

- **Obviously we need to continue with the current efforts in this area.**
  - **Utilize the JTTRR to the maximum extent possible.**
  - **Implement the product of the FI-2010 as soon as is practicable on future system procurements and existing system upgrades.**
  - **Build on the work accomplished under the FIT program and see if it can be revised to accommodate current and projected data throughput and user's control of message size and content requirements.**
- **In addition to the efforts mentioned above, several other tasks need to be initiated to ensure success in the area.**

PROPOSED PRACTICAL APPROACH

- As mentioned earlier, the ETMG is actively engaged in generating standards to help address the commonality issues with T&T.
- Detailed technical, performance and engineering data has been collected for all the 55 different T&T configurations identified.
- A detailed engineering review is being conducted on each component and sub-component for all 55 configurations.
  - Identifying similarities
  - Comparing performance requirements and capabilities.

PROPOSED PRACTICAL APPROACH

- **The key area of the study is to determine what if any hardware/software components could be standardized with a high chance of success.**
  - **Based on similar technical characteristics across all or most of the systems.**
- **The following is an example of some of the items being evaluated for potential standardization.**

Pod Shell	**Data Link**	**Encryption**
Umbilical	**Power Supply**	**On-board Record**
Mass Properties	**S/W Architecture**	**Processor**
IMU/IRU	**Interface Unit**	**A/C Interface**
GPS Receiver	**Connectors/Pin Outs**	**Nose Cone**

PROPOSED PRACTICAL APPROACH

- **The ETMG will initiate efforts to generate standards for those areas/components identified to be the best candidates for standardization.**
  - **Based on thorough engineering analysis, cost and technical feasibility tradeoffs.**
- **Of the list of proposed areas for standardization, the ones that have the most applicability to existing fielded systems will be addressed first.**
  - **The components/sub-components most likely to be incorporated during planned upgrades not involving total system redesign.**
- **Those items most applicable for entirely new systems will be addressed later.**
  - **Standard buss architecture, wiring harnesses, connectors, etc.**

PROPOSED PRACTICAL APPROACH

- One of the key areas that should be addressed first is the ground segment portion of T&T systems.
- Each T&T system requires its own ground data link controller/processor as well as an array of ground sites.
- Compared to the number of airborne participant packages fielded, the number of ground systems are small.
- The real key first step should be to develop a single common ground data link controller/processor and data display system.
  - Accommodate the most common fielded systems (data links and data formats)
  - Accommodate the new systems planned over the next 3-5 years: EnRAP, JCTTS follow-on, etc.

PROPOSED PRACTICAL APPROACH

- **Addressing the ground system first has many advantages!**
  - **Most of the effort involves integrating existing systems into one system.**
  - **Not constrained by size, weight, power requirements, etc.**
  - **Single array of ground stations with multiple datalink frequency capability.**
    - » **Able to communicate with the most common datalinks currently in use.**
  - **Ground processors composed primarily of COTs computers with software loaded to handle the data link control and data display of the most common systems fielded now.**
  - **The cost to replace the ground segment is much cheaper than replacing all the airborne assets.**

PROPOSED PRACTICAL APPROACH

- **Addressing the ground system first has many advantages! (cont.)**
  - **Allows the development of a new common data link system for potential use by T&T systems.**
  - **If designed during the course of one the new program data link developments (EnRAP, MSTCS, JTCTS follow-on, etc), it will allow control of the new data link while still being compatible with existing legacy systems.**
  - **This would allow many of the fielded systems to work together at the same time even though the airborne segment remains in different configurations.**
  - **It would allow for a single array of ground sites to support testing and training for many different fielded systems.**
    - » **Reduce the cost of maintaining multiple arrays of ground stations and ground processors.**

PRACTICAL APPROACH SUMMARY

- **The problem associated to standardizing T&T systems is large and complex.**
- **It can be done with a methodical and phased approach.**
  - **Continue use of the JTTRR**
  - **Incorporate the product of FI-2010**
  - **Update and incorporate the product of the FIT program**
  - **Develop and incorporate the use of the hardware/software standards under development by the ETMG**
- **And most importantly, consider the development of a single standardized ground system capable of accommodating the planned new systems as well as the most common fielded systems!**